Catalytic Conversion of Carbohydrates to Value Added Chemicals : Alternative Solvents and technologies

Plenary Lecture

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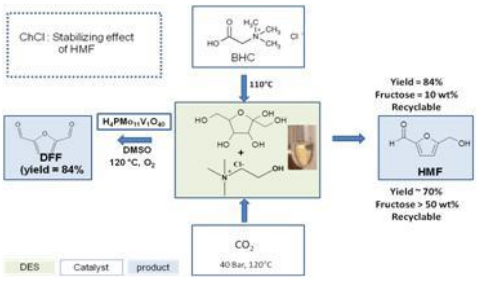
The catalytic conversion of carbohydrates to value added chemicals or platform molecules is the topic of numerous researches. One of the challenges is the conversion of a highly concentrated solution of carbohydrates in an environmentally friendly process. To this aim, the nature of the catalyst, the solvent or an assisted catalyst [1] (i.e. combination of a catalyst and ball milling) can be investigated.

In a first part, the effect of the solvent nature will be presented. An interesting class of solvents is gaining more and more attention: Deep Eutectic Solvents (DES) [2] or Low Melting Mixtures (LMM). Formation of these solvents can be obtained by simply mixing together two safe components, (cheap, renewable and biodegradable) which are capable of forming an eutectic mixture or a low melting mixture. One of the most widespread components used for the formation of these solvents is choline chloride (ChCl). ChCl is a very cheap, biodegradable and non toxic quaternary ammonium salts which can be either extracted from biomass or readily synthesized from fossil reserves (million metric tons) through a very high atom economy process. In combination with safe hydrogen bond donors such as carbohydrates, ChCl is capable of rapidly forming a DES/LMM. We have studied several catalytic systems in the synthesis of furanic derivatives showing the benefit effect of these solvents in such reactions (Scheme 1) [3-5]. Some examples will be presented where ChCl can help to control the selectivity of the reaction by providing interactions with the furanic derivatives avoiding their degradation starting from highly concentrated solutions of carbohydrates. Some new insights of the mechanism will be provided.

In a second part, an example on a combination of a heterogeneous catalyst and a mechanical treatment will be demonstrated in the glycosylation reaction, showing that assisted catalysis is a promising sustainable route to obtain the desired product [6-7].



Scheme 1. Catalytic conversion of carbohydrates to furanic derivatives in the presence of ChCl.

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